

CLAIMS

1. A fuel cell system comprising:

a fuel cell stack utilizing hydrogen and an oxidizer to generate electricity, the fuel cell stack having an inlet for introducing hydrogen and an outlet for removing unreacted hydrogen;

5 a re-circulation loop for returning unreacted hydrogen to the fuel cell stack, the re-circulation loop providing a flow path between the inlet and the outlet of the fuel cell stack;

a hermetically sealed assembly comprising a blower portion for pressurizing hydrogen in the re-circulation loop and a motor portion for driving the blower, the blower portion of the assembly in fluid communication with the re-circulation loop; and

a source of make-up hydrogen, the source adapted to introduce make-up hydrogen in the motor portion of the assembly at a pressure greater than the pressure in the blower portion of the assembly.

2. The fuel cell system of claim 1, further comprising an exhaust line for venting a portion of the unreacted hydrogen from the re-circulation loop.

3. The fuel cell system of claim 1, wherein the re-circulation loop includes a conduit that provides a flow path between the outlet of the fuel cell stack and an inlet of the blower portion of the assembly.

4. The fuel cell system of claim 3, wherein the re-circulation loop further comprises a discharge line, the discharge line providing a flow path between an outlet of the blower portion of the assembly and the inlet of the fuel cell stack.

5. The fuel cell system of claim 1, further comprising a conduit that provides fluid communication between the motor portion of the assembly and the source of make-up hydrogen.

6. The fuel cell system of claim 1, further comprising a wall separating the motor and blower portions of the assembly, the wall having an aperture that allows make-up hydrogen to flow from the motor portion of the assembly into the blower portion of the assembly.

7. The fuel cell system of claim 1, further comprising a conduit that provides a flow path between the motor portion of the assembly and the re-circulation loop.

8. An apparatus for replenishing hydrogen in a fuel cell stack, the fuel cell stack having an inlet for introducing hydrogen and an outlet for removing unreacted hydrogen, the apparatus comprising:

5 a re-circulation loop for returning unreacted hydrogen to the fuel cell stack, the re-circulation loop providing a flow path between the inlet and the outlet of the fuel cell stack;

10 a hermetically sealed assembly comprising a blower portion for pressurizing hydrogen in the re-circulation loop and a motor portion for driving the blower, the blower portion of the assembly in fluid communication with the re-circulation loop; and

a source of make-up hydrogen, the source adapted to introduce hydrogen in the motor portion of the assembly at a pressure greater than the pressure in the blower portion of the assembly.

9. The fuel cell system of claim 8, further comprising an exhaust line for venting a portion of the unreacted hydrogen from the re-circulation loop.

10. The apparatus of claim 9, wherein the assembly further comprises a controller portion for regulating the motor, the controller portion in fluid communication with the motor portion of the assembly.

11 The apparatus of claim 10, further comprising a conduit that provides a flow path between the source of make-up hydrogen and the controller portion of the assembly.

12. The apparatus of claim 11, wherein the controller portion of the assembly includes a variable frequency drive.

13. The apparatus of claim 8, wherein the blower portion of the assembly is a partial emission-type blower.

14. The apparatus of claim 8, wherein the motor portion of the assembly includes a brushless AC motor.

15. The apparatus of claim 8, wherein the assembly further comprises a wall separating the motor and blower portions of the assembly, the wall having an aperture that provides a flow path for make-up hydrogen flowing from the motor portion of the assembly into the blower portion of the assembly.

16. The apparatus of claim 15, wherein the assembly further comprises a rigid shaft extending from the motor portion of the assembly into the blower portion of the assembly through the aperture in the wall separating the motor and blower portions of the assembly, the rigid shaft providing mechanical coupling between the blower portion of the assembly and the motor portion of the assembly.

17. The apparatus of claim 16, wherein the assembly includes a labyrinth seal disposed in the aperture between the wall and the rigid shaft.

18. The apparatus of claim 8, further comprising a conduit that provides a flow path between the motor portion of the assembly and the re-circulation loop.

19. A method of replenishing hydrogen in a fuel cell stack, the fuel cell stack having an inlet for introducing hydrogen and an outlet for removing unreacted hydrogen, the method comprising:

5 re-circulating unreacted hydrogen from the outlet of the fuel cell stack to the inlet of the fuel cell stack using a blower;

driving the blower using a motor, the motor hermetically coupled to the blower and having a flow path that provides fluid communication between the motor and the blower; and

10 introducing make-up hydrogen in the motor at a pressure higher than the pressure in the blower so that make-up hydrogen flows from the motor into the blower through the flow path.

20. The method of claim 19, further comprising:

routing a portion of the make-up hydrogen through a conduit connecting the motor and the re-circulation loop.